

## Optimisation of energy absorbers in driver's cab Impuls I rail vehicle

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*Abstract:* During numerical modelling of the impact test of electric multiple units (EMU) driver's cab Impuls I rail vehicle from Newag S.A. was noticed the need to investigate the methodology of design of energy absorbers, because properly designed crush zones provide a controlled collision process for specific conditions. The most popular method in the design of energy absorbers is to estimate square cross-section tube thickness and the tube width from the equation of dynamic axial crushing force. When the shape of axially loaded tubes is circular, or honeycomb than modelling with Finite Element Method is necessary, and crashworthiness criteria are introduced in the process of design. Compared to the current state of the art, the novel approach is trying to take into consideration all shapes of cross-sections: rectangles, circles, honeycomb, etc. The finite element method is combined with rigid body dynamics and friction model. The developed method allows to apply optimisation process of energy absorbers used in Impuls I rail vehicle crash tests. Design criteria for crashworthiness and energy presented in this article are absorption energy-based metrics with energy absorption EA, specific energy absorption SEA and crash load efficiency. The paper presents current results of numerical calculation that are intended to complement the test results and develop modified energy absorbers models.

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